A bio-economic model to analyse the performance of cotton farms in Mali

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Introduction

The production of cotton in Mali was doubled and reached record levels in the last decade attributed to increased planted area, as well as favourable weather and few pest problems. However, this record wasn't followed by an improvement of cotton productivity which practically stagnated since several years (IER/CMDT/OHVN, 1998). This stagnation coincided with the decrease of world cotton price and the increase of the input price due to the rise of petrol prices; all these factors have led in the last years to a drop of farm income in most cotton farms. To enhance farms performance and support farmers and policymakers to design the future strategies to face this new context, an *ex-ante* assessment would be very useful. The aim of this paper is to asses the impact of this conjunction of factors on farm income, land use and cotton production and to predict the effects of the likely management strategies developed recently to handle the problem of market instability and yield stagnation.

Methodology

The used method is based on the bio-economic farm model "FSSIM" (Farm System Simulator) developed within the EU FP6 SEAMLESS. FSSIM is a non-linear mathematical programming model (Louhichi et al., 2007).

The model was applied to a set of identified farm types. We show in this paper the results of only one farm type called "large farm".

Figure 1: Case study zone in Mali

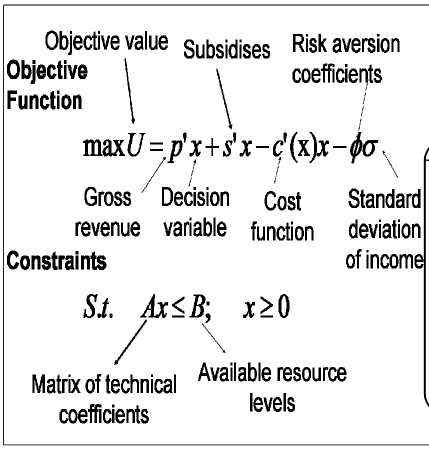
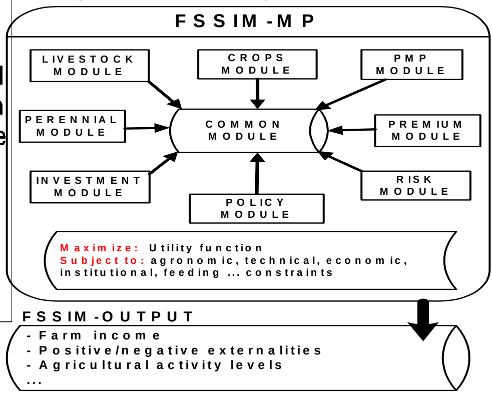


Figure 2: FSSIM - Static comparative programming model



Results

Simulated scenarios: (i) 15% cut of cotton price; (ii) 23% increase of fertiliser price; (iii) Adoption of alternative activities based on new cropping techniques.

Table2. Impact of alternative alternatives on farm's crop allocation

Crops	Ref. area (ha)	Share of CA in total farm area (%)	Share of AA in total farm area (%)
Maize	1.15	100	
Cotton	3.48	34	66
Mile	3.64	37	63
Sorghum	2.29		100

The model chooses a partial substitution of current activities (CA) by alternative ones (AA) meaning that not all the alternative cropping techniques are competitive under the taken assumptions.

Table1. Impact of the change on cotton and fertilizer prices on land use and farm income

	Crop allocation (% change to reference)					
	Maize-Néibé	Cotton	Maize	Mile	Sorg.	Farm income
Reference run	**9.10**	**28.93**	**12.38**	**32.2**	**17.39**	**2313**
15% cut of cotton price	-0.72	-2.82	3.30	1.20	-0.95	-4,8
23 % raising of fertilizer price	-2.26	-0.30	-0.31	1.65	1.22	-1.5
Cumulated effect	-1.26	-3.50	4.16	1.92	-1.32	-3.01

As expected, the change in cotton and fertilizer prices (i.e. the two first policy scenarios) would induce a reduction of area devoted to cotton crop and to Maize-Neibe crop which have a higher level of fertiliser use. In terms of economic impacts, these two scenarios will affect negatively but moderately the farm income, reaching the 5%.

Conclusion

In famer's opinion these results correspond to their rotation management strategy which according to external pressures gives priority to the cereals which make it possible to ensure family consumption. Farmers prefer to decrease the allocation reserved for the cotton crop which is consuming much nitrogen fertilizer.

Reference

IER/CMDT/OHVN. 1998. Mémoire de réunion de concertation sur la baisse de rendement de la variété NTA 88-6 au cours de la campagne 97/98. Institut d'Economie Rurale. 'Tarla. Mali.

Louhichi. K.. Flichman G.. and Blanco M. 2007. A Generic Mathematical Programming Model (FSSIM-MP) for farming systems analysis. Farming System Design 2007. Catania. Italy.